

(3) Remarks

This paper presents amended claims and arguments believed sufficient to overcome the prior art rejection made in the final rejection.

In view of applicant's presentation of the amended claims with a Request for Continued Examination, it is believed that all claims should now be allowed.

Claims 3, 5, 6 and 8-15 are now present in this application.

Claims 1, 2, 4 and 7 have been cancelled.

Claims 13-15 have been added.

Claim Amendments

Amendments have been made, centering on new claims 13 – 15, which find full support in the specification. For example, taking new claim 13 as representative, the preamble finds support in the original claims and in the translation at page 5, line 31 through page 6, line 3. The limitation of part a) of claim 13 is supported, for example, at page 7, lines 1-6. The limitation of part b) of claim 13 is supported, for example, at page 9, lines 8-9. The limitation of part c) of claim 13 is supported, for example, at page 9, lines 10-11. The limitation of part d) of claim 13 is supported, for example, at page 9, lines 12-14. The first portion of claim 15 (comparing said size and eccentricity of the propulsion force with stored standard values) is supported, for example, by original claim 1. The second part of claim 15 (to avoid a risk of damage of pipe elements) is supported, for example, at page 9, lines 14-17.

Specification Objection – 37 CFR 1.77(b)

The examiner objected to the specification for lacking suggested headings; however, applicant notes that the language of the rule is not mandatory and wishes to defer any amendment until allowable subject matter is indicated.

Applicant is willing to work with the examiner to provide section headings as appropriate prior to formal allowance.

Claim Objections

All pending claims are presented in idiomatic English in full compliance with applicable statutory and regulatory requirements.

Claim Rejections – 35 USC §103(a)

Claims 1 through 4 and 12 were rejected under 35 U.S.C. §103 as being unpatentable over US Patent No. 4,432,667 to Richardson. Claim 5 was not treated. This rejection is respectfully traversed.

It will be recalled that the invention provides a method for determining the propulsion force, its eccentricity in relation to the neutral axis and/or the advance direction of a series of pipe elements, wherein a pressing device applies force to the pipe elements and the faces of fluid-filled expansion elements arranged in the joints between the pipe elements.

It will be seen that the invention is completely different from US 4,432,667 (Richardson). While Richardson teaches advancing each pipe element individually ("worm-like movement") and teaches away from the "old" method of pressing forward the pipeline as a whole (col. 1 lines 8 - 29), the invention proposes to use the "old" method and to control the forces that are effective in a predetermined pipe element by measuring deformation and pressure at the joint and by calculating the size and eccentricity of the propulsion force.

The claims as now amended and presented demonstrably distinguish from Richardson.

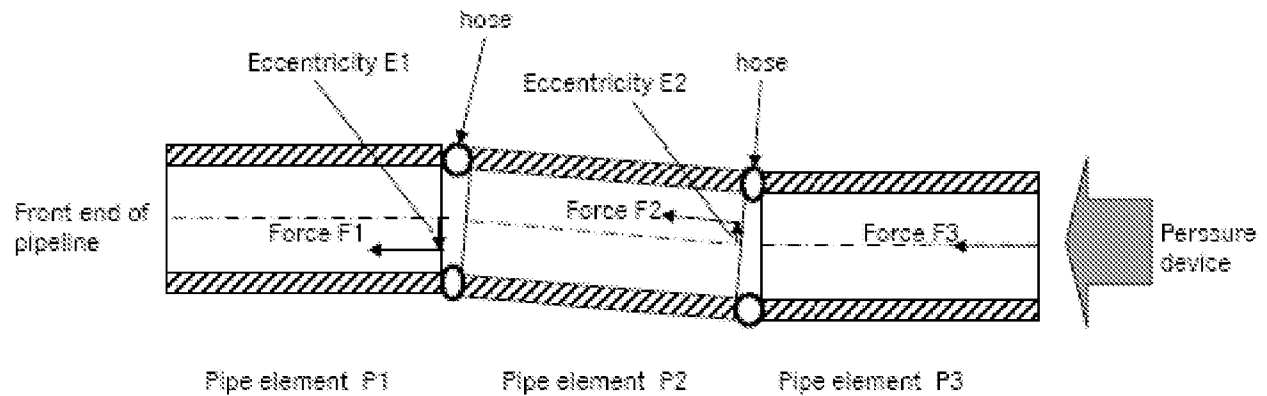
Applicant provides a comparison of the new independent claim 13 with the prior art.

Claim 14 words the method differently, calling for a "method for producing a pipeline of pipe elements in ground" which includes principal features of the method of claim 13.

Comparison of Claim 13 to Richardson, U. S. Patent No. 4,432, 667

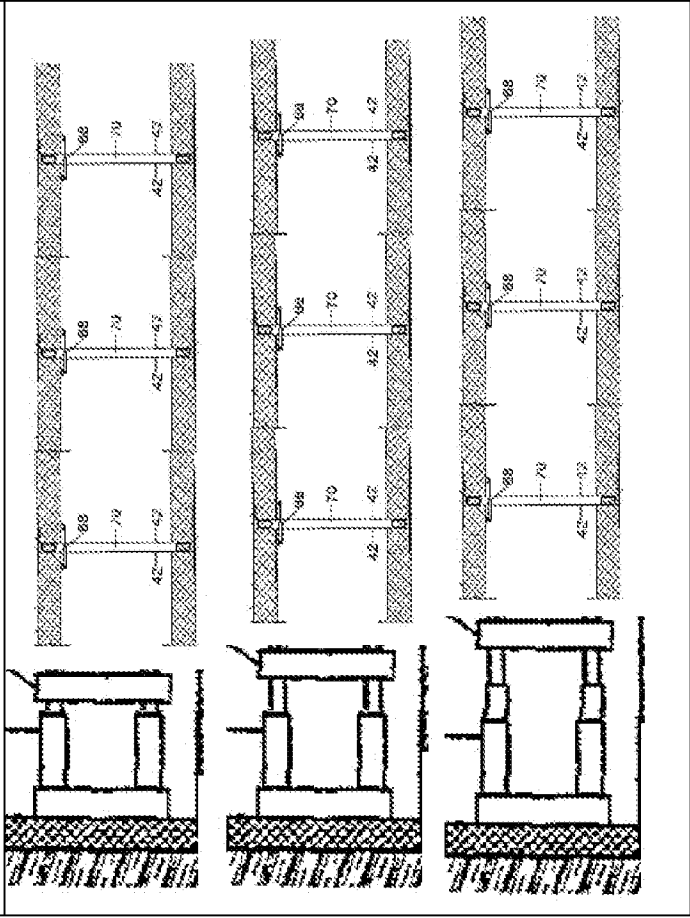
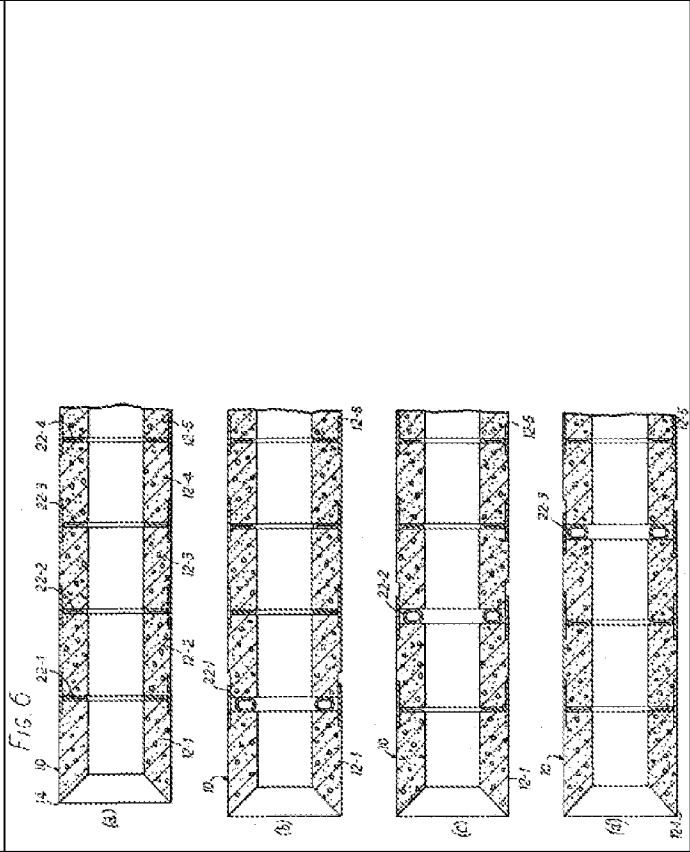
Claim 13	Novelty	prior art: US 4,432,667
A method for determining a propulsion force	Not shown	"Method of non-disruptively installing a tunnel or shaft lining" (col. 1 line 30-32)
that is effective in a predetermined pipe element of a pipeline during advancing said pipeline	---	"At initiation of the advance of a section 12 where the junction is closed, the initial thrust on admission of the compressed air is 29,464 kg (29 tons)." col. 4 lines 64-66
by a pressing device resting on an abutment and pushing the entire pipeline in the advance direction by a length of at least one pipe element, comprising the steps of:	Not shown	Each pipe element is pressed forward individually by torus resting on rearward pipe element: "perichaetial (i.e. worm-like) movement in the forward direction by arranging that any particular section is subjected to the force of the inflated torus at its rearward"(col. 1 line 67 – col. 2 line 1) "movement of the tunnel lining section in the forward, longitudinal direction is caused by the force exerted by the torus"(col. 1 line 47-49)
a) measuring a fluid pressure in an expansion element in the form of a hollow profile provided in a joint between said predetermined pipe element and a further pipe element, said hollow profile being filled with a pressure-resistant fluid,	Not shown	"Typically, the system is operated with compressed air a a pressure of 485.2kg/sq. meter (100 psi)." col. 4 lines 52-53
b) measuring a deformation of said joint by at least three local expansion measurements,	Not shown	-
c) calculating geometric data of an expansion plane of said joint from said at least three local measurements,	Not shown	-
d) determining size and eccentricity of the propulsion force in relation to neutral axis (N) or to an advance direction based on the measuring of the fluid pressure and based on the geometric data of the expansion plane.	Not shown	-

The Invention



The propulsion force to move the pipe line through the ground is applied to the last pipe element P3 of the pipeline. The hose at the joint between consecutive pipe elements is an elastic pressure transmitter from one pipe element P3 to the next one P2 and from P2 to P1 etc. Since the propulsion force is established at the beginning (back end) of the pipe line by a pressing device and since the propulsion force diminishes along the pipeline because of friction and other effects that act on each pipe element in a different way, it is in general not known how much the propulsion force is at a particular pipe element. Any change of direction/orientation of the pipeline at a joint between two pipe elements has the effect that the propulsion force is applied to the next pipe element (P1, P2) with a certain eccentricity (E1, E2). The capacity of a pipe element to bear a particular propulsion force without breaking depends on the amount and direction (eccentricity) of the propulsion force. More eccentricity means least allowable propulsion force.

The invention teaches to measure the pressure in the hose and the deformation of the joint (i.e. the expansion of the hose at three different spots of the joint) and to calculate the propulsion force that is effective at a particular joint. This overcomes the disadvantage of prior art systems that are not able to build curvilinear pipelines by using a single pressure device. It also allows to optimize the wall thickness of the pipe elements.

Invention	Richardson
	<p><i>Fig. 6</i></p> 
<p>The pressing device is placed at the beginning (back end) of the pipeline and pushes the entire pipeline forward. The joints have a pressure measuring device and deformation measuring device.</p>	<p>Each pipe element is advanced separately by inflating and deflating a hose in the joints. The pipeline is not advanced as a whole, but in a perichaetal movement. Richardson describes his invention as eliminating the need for traditional hydraulic jacking arrangements, reducing the structural requirements for the monolithic lining sections, minimizing the size of working shafts and eliminating the need for a substantial reaction wall.</p>

As just demonstrated, the method of the invention and the structure described for carrying it out are very different from device and method of Richardson in structure and function.

As pointed out in applicant's last response, Richardson relates to the installation of *tunnel linings* including shaft linings and underground pipelines (col. 1, l. 5-8), which are moved in a perichaetial (*i.e.*, worm-like) movement. The Richardson process and apparatus involves arranging an assembly of monolithic tunnel lining sections in end to end relationship and longitudinally advancing them with worm-like movement by sequentially inflating and deflating expandable torus members 22 interposed between the lining sections (col. 1, l. 30-38). Richardson does not employ a pressing device or measure the pressure it exerts or the deformation of joints between pipe elements as is presently claimed. It also does not calculate eccentricity or propulsion force provided by the pressing device to provide situational awareness or directional control of the propulsion.

Robinson does not meet the terms of the present claims in terms of

- measuring a fluid pressure in an expansion element in the form of a hollow profile provided in a joint between said predetermined pipe element and a further pipe element, said hollow profile being filled with a pressure-resistant fluid,
- measuring a deformation of said joint by at least three local expansion measurements,
- calculating geometric data of an expansion plane of said joint from said at least three local measurements, and
- determining size and eccentricity of the propulsion force in relation to a neutral axis (N) or to an advance direction from said measuring of the fluid pressure and from the geometric data of the expansion plane.

The only steering Richardson can provide is from hydraulic rams in a special lead section 50 wherein suitable adjustment of hydraulic rams 60, makes it possible to alter the plane of the thrust ring 62. This imparts a steering effect, which is very different than that claimed and requires a specially-configured section 50 (Fig. 11, col. 7, l. 23-26).

The Robinson tunnel lining assembly includes a series of tunnel lining sections 12-1 to 12-8, wherein section 12-1 is a lead section fitted with a cutting edge 14 (Fig. 1, col. 3, l. 38-40). The space between the sections 12 is occupied by a respective inflatable torus 22-1 to 22-7 having a fluid inlet 24 through which compressed air may be admitted to and exhausted from the torus (Fig. 1, col. 3, l. 50-55). The inlet 24 of the torus 22-1 and every succeeding third junction are connected to a first compressed air main 26-1; similarly other tori are connected to a second and third compressed air main 26-2, 26-3 (Fig. 1, col. 3, l. 60-67). Each main is connected to a source of compressed air and to atmosphere through a respective 3-way valve 27-1, 27-2, 27-3 (Fig. 1, col. 3, l. 68 – col. 4, l. 2).

The different nature of the forward motion and the steering apparatus from that claimed can be seen from a comparison of Figs. 1 and of 11 of Robinson, directly below to Figs. 1 and 9 of the invention, shown below those of Robinson.

Robinson

Fig. 1

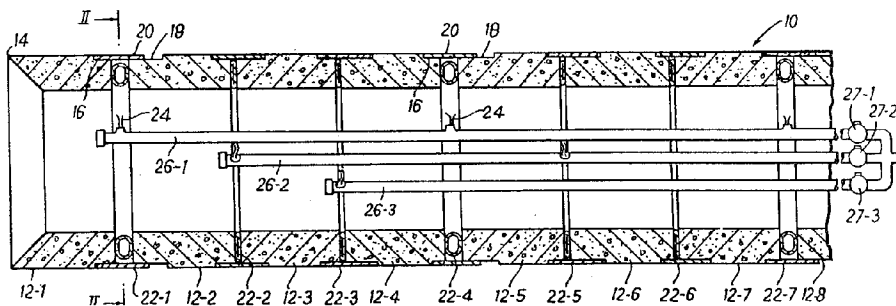
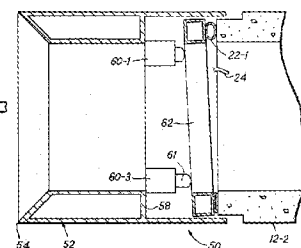


Fig. 11



The present invention:

Fig. 1

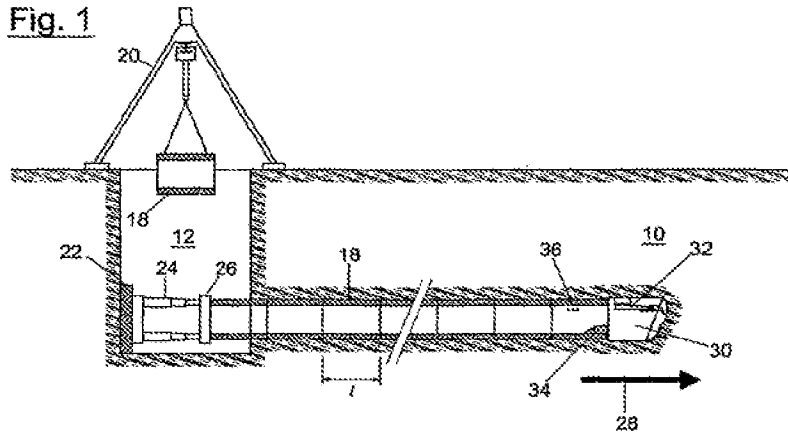
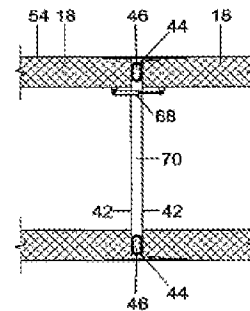


Fig. 9



In sharp distinction to present the invention, Robinson does not measure the fluid pressure and/or the deformation of the joints, and the propulsion force and eccentricity are not calculated, stored, or compared with standard values from these parameters (claim 1). Moreover, the values are not converted into control commands for the pressing device and/or fluid supply or discharge from expansion elements (claim 2).

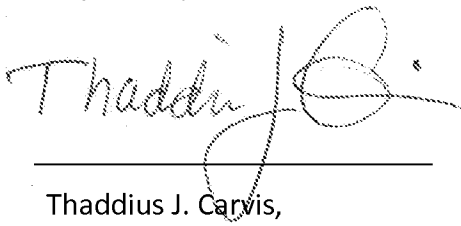
The examiner acknowledges that Richardson does not expressly teach the step of measuring parameters and use of the same for controlling the propulsion force. However, the examiner is of the opinion that it would have been obvious to modify Richardson's method to include measuring and controlling in order to provide for the automation of activity to replace manual activity.

In response to applicant's arguments in the prior response, the examiner has stated that while applicant argues the method of Richardson '667 does not require a pressing device, the examiner is of the opinion that the prior art method requires the use of a pressing device in the form of hydraulic rams (60). However, in the embodiment of Fig. 9 referenced by the examiner, the thrust is still provided by the forward thrust is still imparted by inflating the torus 22-1 against the shield 52 to cause movement. See, for example, col. 6, lines 61-68.

The examiner also states that applicant argues the method of Richardson '667 does not require the step of measuring fluid pressure or joint deformation, but that the examiner contends the prior art method requires the step of measuring the fluid pressure and calculating the propulsion force as discussed in column 4 at lines 52 through 67. The examiner also asserts that Richardson '667 is concerned with the eccentricity of the pipe elements and discusses control of the same to effect steering as desired in column 7 at lines 1 through 28. However, the cited passage does not specify control as set out by applicant. See specifically, claim 13, and steps a through d. Robinson talks of representative operating conditions only. There is no measuring, calculating and determining as in applicant's method.

Applicant has endeavored to place the application in condition for allowance, but if for any reason the examiner sees need for formal changes, she is invited to call the undersigned. Accordingly, reconsideration and allowance of all claims are believed in order and are requested.

Respectfully submitted,

A handwritten signature in cursive script, reading "Thaddius J. Carvis", is written over a horizontal line.

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